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ABSTRACT

In a longitudinal field experiment, 42 groups were assembled on the factors of individual ability and attitude similarity resulting in a 2 x 2 crossed ANOVA design. These groups then worked on six projects which spanned a three-month time period. For each project, measures of group performance and group cohesion were taken. Analyses showed that high ability groups exhibited the best performance whereas attitudinally similar groups expressed the greatest cohesiveness. In addition, correlational data suggest that the effect of attitude similarity on cohension is not immediate, but develops over time, and that across the six projects, performance can be both positively and negatively related to cohension. (Author)

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A LONGITUDINAL FIELD INVESTIGATION OF THE IMPACT OF GROUP COMPOSITION ON GROUP PERFORMANCE AND COHESION[1]

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A LONGITUDINAL FIELD INVESTIGATION ON THE IMPACT OF GROUP COMPOSITION ON GROUP PERFORMANCE AND COHESION

One of the most pervasive questions concerning group effectiveness involves group composition. How do the skills, personality characteristics, likes and dislikes, etc., of individual group members influence the output of the group? If answers could be found to questions like these, then groups could be assembled so as to maximize the occurance of desirable group outcomes.

To this end, some research in group composition has focused on the skills and abilities of individual group members. It was assumed that group effectiveness could be enhanced by selecting group members on the basis of technical competence. Standard selection procedures for group composition were based on this assumption. However, in their review of the group literature, McGrath and Altman (1966) concluded that while individual ability appears to predict individual performance, there is little evidence that group performance can be reliably predicted from knowledge of member ability.

Yet this need not always be the case. Steiner (1972) argues that group performance depends on the adequacy of the resources members have at their disposal and upon the manner in which these resources are used. Determination of relevant resources depends on an analysis of the demands and characteristics of the task. Thus, through consideration of task demands, it should be possible to assemble effective work groups on the basis of relevant individual abilities. At the present time, job analysis is valuable for individual selection and placement (McCormick, Jeanneret, & Mecham, 1972). It remains to be determined the degree to which such approaches can be useful for group composition.

A second variable of interest to group researchers has been the interpersonal compatability of the group members. Here it is assumed that on tasks where coordination or joint activity is involved, member compatability becomes an important determinant of group performance. This is necessary for the group to function without problems of communication or authority, or any other interpersonal problems. Available research suggests that both actual group performance and anticipated performance and satisfaction can be increased by assembling group members on the basis of self-selection (Van Zelst, 1952), need compatability (Reddy & Byrnes, 1972), and attitude similarity (Castore & DeNinno, 1972, 1975). The relationship of such selection procedures to compatability and performance is, however, poorly delineated and not well understood.

In an attempt to discover additional characteristics which would affect compatability, the theoretical formulations and supporting research of Byrne (1971), Heider (1958), and Newcomb (1961) appear useful. They suggest that the similarity of attitudes and values which individuals hold may be an important determinant of their ability to interact effectively. When a high concordence on attitude issues exists, interpersonal interaction is facilitated, and when a low concordence on attitude issues exists, interpersonal interaction is inhibited or can even take the form of hostility. Continuing this line of reasoning, one would expect that on group tasks which require member interaction, attitude similarity would lead to effective group performance while attitude dissimilarity might well suppress effective group performance.

In spite of the practical value of knowing the effects of group composition on group outcomes, recent reviews of small group research report that in general, there exists a lack of attention to the problems of group composition (Helmreich, Bakeman, & Scherwitz, 1973; McGrath & Altman, 1966).

Further, these reviews also mentioned several added potential problem areas which characterize group research and make effective studies of group composition more difficult: (a) Research on small groups has been conducted almost exclusively in laboratory settings, (b) Ad-hoc groups constructed by the researcher for purposes of the experiment have been studied more often than naturally occuring work groups, and, (c) the functioning of the group typically has been examined at only one point in time as opposed to longitudinal research where repeated observations are taken. The extent to which such laboratory studies with ad-hoc groups working for short time durations have internal validity as well as external validity is questionable. Anderson (1961) stated that individuals in groups require a certain amount of time together before they begin to behave as a group. As a result, the time duration of the experiment may influence the obtained results. Similarly, Lorge, Fox, Davitz, and Brenner (1958) warned against generalizing principles found with ad-hoc groups to groups which interact over time. Clearly, meaningful group research should be designed with these factors in mind.

One purpose of the present investigation was to examine the effects of group member ability and attitude similarity on group performance in a longitudinal field experiment. It is hypothesized that (1) homogeneously high ability groups will out perform homogeneously low ability groups, and (2) attitudinally similar groups will out perform attitudinally dissimilar groups.

A second group outcome of considerable importance is the cohesiveness of the group. Cohesiveness is assumed to be a desirable group outcome since it is typically associated with accurate communication, high satisfaction, and low absenteeism and turnover (Lott & Lott, 1965; Stogdill, 1972). Further, cohesiveness is based in part on the rewards obtained through

group membership (cf. Cartwright, 1968; Lott & Lott, 1965). Therefore, if one assumes that high group performance is rewarding and that ability is related to group performance, then it is hypothesized that homogeneously high ability groups will express greater cohesiveness than homogeneously low ability groups. Accordingly, based on the attitude similarity literature, it is hypothesized that attitudinally similar groups will express greater cohesiveness than attitudinally dissimilar groups.

Finally, in his review of group performance and cohesion, Stogdill (1972) concluded that only under conditions of high group drive will cohesiveness be positively related to productivity. Given low group drive, cohesiveness and productivity will be negatively related. To jump ahead, in the present experiment group performance comprised one-fourth of the subject's grade in a college course on land surveying. Assuming then from the beginning that the groups will be motivated to obtain a high course grade, it is hypothesized that group performance will be positively correlated with group cohesion.

METHOD

Subjects

The subjects were 127 male and six female undergraduate students enrolled in five sections of an introductory course on land surveying. At the first class meeting, subjects were told by the course instructors that the experimenters were interested in examining the performance of the survey groups and that the faculty had given permission for the experimenters to study the students in the course should they (the students) consent. Participation was thus voluntary. No student refused to be included in the study.

Description of the Task

Three and four-person groups worked on six field projects which covered basic techniques in land surveying. For each project, all members of a group received the same group grade. Performance on these projects comprised one-fourth of the student's total grade in the course. It was assumed at the outset of the study that this would constitute a situation in which the subjects were highly motivated.

Specifically, each project contained three separate parts or subtasks. For each subtask, students had to occupy three positions; one person working the plumbline, one person working the transit, and one person writing down the results. Students were required to rotate through the three positions across assignments so that every student had at least one turn at every position. Using Steiner's classification scheme (1972), this task can best be conceptualized as a divisible task (i.e., division of labor), with specified matching to specified positions (i.e., students were assigned to positions), and where group performance was additive (i.e., performance on each project was the sum of the three subtasks). In addition, the task had disjunctive properties. On a disjunctive task, the performance of the group is determined by one group member. This is based on the course instructors judgments that the student working the transit had the greatest influence on the accuracy and hence grade received on the particular project the group was working on.

Assembly of Groups

Groups were assembled to be homogeneously high or low on ability and homogeneously high or low on attitude similarity resulting in a 2 x 2 crossed ANOVA design.

Concerning the ability dimension, following discussions with course instructors, scores on the quantitative section of the Scholastic Aptitude

test (SATQ), and cumulative grade point average (GPA) were selected on a logical basis as indices of task relevant abilities. The following procedure was used to classify groups. For each subject, his/her SATQ score and GPA were converted to z-scores. Assigning equal weight to each z-score, a weighted sum was computed. Subjects were then placed in rank order on the basis of these scores. Homogeneously high ability groups were assembled from students with scores above the median and homogeneously low ability groups were assembled from students with scores below the median.

For attitude similarity, subjects responded on a six-point scale to 20 attitude statements taken from the Survey of Attitudes Questionnaire (Bryne, 1971). These statements covered such inoccous topics as state income tax, legal drinking age, athletics, etc. In each of the five class sections, a correlation matrix was computed which correlated subjects on the basis of their responses to the 20 attitude statements. Within each ability level, homogeneously high attitude similarity groups were assembled from subjects who had high correlations with each other and homogeneously low attitude similarity groups were assembled from subjects who had low correlations with each other. As a check on the manipulation, the grand mean of the intercorrelations for the similar groups was compared to the grand mean of the intercorrelations for the dissimilar groups. The two means were significantly different from each other ($\bar{X}_{similar} = .57$; S.D. = .09; $\bar{X}_{dissimilar} = .25$; S.D. = .10; $t = 11.10$; $df = 40$; $p < .001$).[5]

In all, there were: (1) 7 three-person groups and 2 four-person groups classified as high ability and high attitude similarity, (2) 11 three-person groups and 1 four-person group classified as high ability and low attitude

similarity, (3) 10 three-person groups and 2 four-person groups classified as low ability and high attitude similarity, and (4) 7 three-person groups and 2 four-person groups classified as low ability and low attitude similarity. The six female students were randomly dispersed among the 42 groups. Also, the four-person groups were distributed as equally as possible among the four cells given an odd number of four-person groups.

Assessment of Dependent Variables

For each of the six projects, group performance and group cohesiveness were assessed as dependent measures. Group performance was determined by instructors' grades using a 20 point grading scale with 20 being the highest grade obtainable. Group cohesiveness was based on group member responses to three questions which were typed on a separate page and attached to each project. The operationalization of cohesiveness used here is similar to that reported elsewhere (cf., Schachter, 1951; Schachter, Ellertson, McBride, & Gregory, 1951). Subjects were asked to respond to the questions individually. The three questions were: (1) "How would you describe the way you and the other members of your survey party 'got along' together on this task?", (2) "Would you socialize with the members of your survey party outside of class?", and (3) "Would you want to remain a member of this survey party on future projects?". Responses were made on a seven point scale with high scores associated with favorable responses. For each of the six projects, the three cohesion items were correlated with each other to examine if the items were measuring the same construct. Within each trial, all items were significantly intercorrelated at the .05 level or better. The cohesiveness of a group for any given trial was equal to the summation of the group member responses to the three questions (minimum possible score = 9, maximum possible score = 63). Responses from four-person groups were computed in the same manner with the exception that four-person group totals were multiplied by .75 so as to equate their scores with three-person groups.

In cases of missing data, the mean of the existing members of the group was used in the computation of the group score. Missing data did not exceed seven percent of the total for any given project.

RESULTS

All analyses were conducted with the group as the unit of analysis. For each dependent variable, a 2 x 2 x 6 between-within unweighted means ANOVA with repeated measures on the third factor was conducted. The factors corresponded to high/low ability, high/low attitude similarity, and six trials (projects) respectively. Means and standard deviations are presented in Table 1.

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Insert Table 1 about here
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Since the design included unequal sample sizes, prior to analyses, the homogeneity of variance assumption was examined. Based on Bartlett's Test for unequal N's, the hypothesis of equal cell variance was not rejected for the variable of group cohesion ($p < .15$), but was rejected for the variable of group performance ($p < .01$). Therefore, the obtained F-ratios for performance data should be interpreted as approximate F-ratios. However, it is not known whether the computed F-ratios for the performance data are negatively biased or positively biased. As shown in Table 1, the high ability groups had smaller standard deviations than the low ability groups. If this restriction in variance for high ability groups was due to a ceiling in possible performance ratings (recall that 20 was the maximum performance score), then the group performance mean for high ability groups could be restricted resulting in a smaller mean difference between groups and a potentially negatively biased test statistic. On the other hand, the existence of a ceiling effect also could result in a positively biased test statistic simply due to the smaller observed variance. In all, for the performance data, the results should be interpreted with these considerations in mind.

Results of the ANOVA's for performance and cohesion are presented in Table 2. Specifically, high ability groups demonstrated better overall performance than low ability groups ($\bar{X}_{\text{high ability}} = 18.10$; $\bar{X}_{\text{low ability}} = 17.22$, $p = .02$).[6] Computation of the eta-squared statistic (E^2) showed

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that ability accounted for three percent of the performance variance. Attitude similarity had no statistical effect on group performance. There also was a significant main effect for trials ($p < .001$, $E^2 = .17$). There were no significant interactions. Further, results of the Newman-Keuls statistic on performance data indicated that trials 6, 5, 3, and 4 were all significantly greater than trial 1 ($p < .01$); and that trials 5, 3, and 4 were significantly greater than trial 2 ($p < .01$). No other comparisons reached statistical significance.

There was a significant main effect for attitude similarity on cohesion. Attitudinally similar groups expressed greater cohesion than attitudinally dissimilar groups. ($\bar{X}_{\text{similar}} = 50.89$; $\bar{X}_{\text{dissimilar}} = 47.38$; $p = .04$; $E^2 = .10$). There were no other significant main effects nor interactions for cohesion.

The correlations between attitude similarity and cohesion, and performance and cohesion for the six trials are presented in Table 3. Specifically,

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Insert Table 3 about here
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the relationship between attitude similarity and cohesion tends to increase over trials with the last three trials being significant at $p < .10$ or better. Also, cohesion was positively correlated with performance on the first trial ($r = .28$, $p < .10$) and negatively correlated with performance on the last trial ($r = -.30$, $p < .05$).

DISCUSSION

The results of this experiment gave support to the hypotheses that group performance is dependent on the skills and abilities of the individual group members, and that group cohesion can be facilitated by the construction of attitudinally similar groups. The data also suggest that the impact of such attitude or value compatability on cohesion is not immediate, but requires time to take effect, and that over time, performance can be both positively and negatively correlated with cohesion. No support was found for the hypothesized relationships between group member ability and cohesion, nor between group member attitude similarity and performance.

Addressing the observed relationship between group ability and group performance, it appears that two factors must be considered when assembling work groups according to standard selection procedures. First, it is obvious that task relevant skills and abilities must be identified and measured. Some type of job analysis would certainly be useful here. Second, it is suggested that considerable attention be directed toward the characteristics and demands of the task. In the present study, successful performance on the task was largely determined by the ability of the person working the transit. Since all group members rotated through this position, it is clear that homogeneously high ability groups would perform better than homogeneously low ability groups. However, if students were allowed to permanently place the most capable group member behind the transit, then it would no longer be necessary for groups to be composed of all high ability members. In this case, the ability of one group member could compensate for the lack of abilities of other group members. Therefore, it would appear that the demands and characteristics of the task be considered so as to better specify the technical skill mix required for optimal group performance.

The finding that group ability was not related to cohesion is less clear. It was assumed that if ability was related to performance, and if high performance was rewarding, then ability should influence cohesion. Although ability did have an effect on performance, the actual difference in grades was less than one point on a 20 point scale. Although admittedly post-hoc, it might be suggested that this difference in obtained scores may not have been sufficient to elicit differential feelings of task rewards and accomplishment.

The impact of attitude similarity on cohesion again demonstrates the pervasive effect of this variable. Congruence of attitudes has been found to influence jury decisions (Mitchell & Byrne, 1973), dating behavior, (Bryne, Ervin & Lamberth, 1970), the dollar amount of loans (Golightly, Huffman & Bryne, 1972), and interview decisions (Peters & Terborg, 1975) to name just a few. Given that group cohesion is related to communication, satisfaction, turnover, and absenteeism (Lott & Lott, 1965; Stogdill, 1972), the use of this inexpensive and easily administered technique for assessing this aspect of group composition would seem to merit further investigation.

Along these lines, a post-hoc analysis was made on the frequency of missing data (one type of withdrawal behavior) according to conditions. The observed percents were: (1) high ability/high similarity = 2.87 percent, (2) high ability/low similarity = 2.25 percent, (3) low ability/high similarity = 3.41 percent, and (4) low ability/low similarity = 7.14 percent. Computation of the overall Chi-square statistic approached significance ($X^2 = 7.15$, $df = 3$, $p < .06$). Since the low ability/low similarity condition had by far the greatest amount of missing data, on additional Chi-square was computed which compared this condition to the combination of the remaining three conditions. This Chi-square was significant ($X^2 = 6.72$, $df = 1$, $p < .01$) indicating that groups composed of low ability members who are

attitudinally dissimilar show greater withdrawal behavior than all of the other groups. Finally, the low ability groups had 97 percent more missing data than the high ability groups, and the dissimilar groups had 37 percent more missing data than 16 similar groups. Again, these data are strictly post-hoc, yet if one assumes that missing data represents a form of withdrawal behavior as do turnover and absenteeism, then these results support previous findings and certainly point toward further research where this better can be examined.

The observation that attitude similarity did not influence group performance may be best explained by considering the nature of the task. It was assumed that similarity of attitudes would minimize dysfunctional behaviors among group members. To use Steiner's terms, attitude similarity would be expected to reduce losses due to faulty group processes (1972). However, Steiner also states that when group members are assigned to positions, as was done in this experiment, that the effect of group processes on performance is truncated. Therefore, the nature of the task may have limited the degree to which attitude similarity could influence group performance.

Although no predictions were made for a trials main effect, there was a significant difference for performance. Grades tended to be lowest on projects one and two, highest on projects three and four, and then drop off slightly on projects five and six. A post-experimental discussion with the course instructors suggested one possible reason for these findings. While all of the projects were rated as equal in difficulty, the instructors stated that projects three and four covered the most interesting material; projects five and six, the least interesting material; while projects one and two covered material that could be considered of intermediate interest.

If these judgments are correct, then these results are in partial agreement with the findings of Pepinsky, Pepinsky, and Pavlik (1960). They concluded that group performance is highest on tasks which are characterized by variety, decision making, and coordination. Factors which all can make the task more interesting. This finding again emphasizes the need to consider the task as a determinant of group performance (see Hackman; 1968, 1969 for a more complete discussion of the importance of task characteristics).

Finally, of considerable interest were the obtained correlations between attitude similarity and cohesion, and between cohesion and performance. Examination of Table 3 shows that attitude similarity and cohesion were not significantly correlated until the fourth project. Had the study ceased after one or two projects, no relationship between attitude similarity and cohesion would have been observed. This certainly questions the findings, or lack of findings, sometimes found in the typical group experiment done with ad-hoc groups over short time durations.

The correlations between cohesion and performance are just as striking. Stogdill (1972), in his review of cohesion and productivity, reported 12 significant positive correlations, 11 significant negative correlations, and 11 nonsignificant correlations. The results obtained in this study provide additional evidence for the equivocality between cohesion and performance. In this instance, had the experiment stopped after the first project, the hypothesized positive correlation between group performance and cohesion would have received some support. However, by the time of the sixth and final project, the two variables were significantly negatively correlated. Unfortunately, in the present experiment it was assumed that all groups would have high drive, and independent measures of drive were not assessed. If they had, then Stogdill's predictions concerning the moderating effect of group drive on the performance/cohesion relationship could have been

examined. On an ad-hoc basis, conversations with the instructors suggested two related reasons for the findings. First, the students, after some short time in the course, might have become aware that almost no group would receive a grade lower than a "B" for this portion of the course. Also, the high ability groups had virtually assured a high grade by the end of the third-fourth project. Both factors, although not verifiable by direct recourse to the subjects' impression, would have, ala' Stogdill's model, produced the results obtained. Research where group drive and cohesiveness can be experimentally manipulated is required in order to better understand how cohesion and performance are related.

In all, the results of this field experiment suggest that groups can be assembled so as to maximize the occurance of desirable group outcomes. But perhaps more importantly, the results also stress the importance of longitudinal research. While this type of data collection usually is more costly (and messy) than one-time laboratory studies, the utility of the data for understanding group behavior may well be worth the added expense and anguish.

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FOOTNOTES

[5]Degree of attitude similarity also was computed by examining the difference scores between group member response profiles to the 20 attitude statements (see Blum & Naylor, 1968, pp. 72-74). The two procedures showed over 90 percent agreement in classification of groups. The correlation index was used for all analyses.

[6]So as not to penalize those students who were placed in low ability groups, the course instructors were asked to add one point to these students' project grades prior to computation of their final course grades.

Table 1

Means and Standard Deviations for Dependent Variables

	HIGH ABILITY				LOW ABILITY			
	HIGH ATTITUDE SIMILARITY		LOW ATTITUDE SIMILARITY		HIGH ATTITUDE SIMILARITY		LOW ATTITUDE SIMILARITY	
	$\bar{X}$(N=9)	S.D.	$\bar{X}$(N-12)	S.D.	$\bar{X}$(N-12)	S.D.	$\bar{X}$(N=9)	S.D.
Trial 1								
Performance	17.11	1.97	16.25	.97	16.00	3.64	15.00	4.47
Cohesion	48.79	6.65	47.50	6.40	50.17	5.31	48.89	4.68
Trial 2								
Performance	17.00	2.40	17.67	1.56	16.17	3.69	15.33	4.15
Cohesion	50.00	6.27	46.58	6.92	50.42	4.54	47.89	6.97
Trial 3								
Performance	19.11	1.36	18.92	1.24	18.33	2.61	18.22	3.19
Cohesion	51.00	6.04	48.08	5.33	52.75	3.28	48.56	4.72
Trial 4								
Performance	19.56	1.33	19.17	.94	18.75	1.29	18.56	1.59
Cohesion	51.22	5.85	47.25	6.74	52.67	4.98	47.78	5.85
Trial 5								
Performance	18.89	1.27	18.58	2.02	17.25	2.56	17.56	2.07
Cohesion	50.56	7.45	46.75	6.78	51.68	5.57	45.78	5.93
Trial 6								
Performance	17.33	1.73	17.67	1.97	17.58	1.08	17.89	1.90
Cohesion	51.00	6.87	46.67	8.14	50.50	9.38	46.78	5.83

Table 2

Summary of ANOVA's for Performance and Cohesion

	M.S.	df	F	Eta^2
Performance				
Ability (A)	48.26	1	5.33*	.03
Att. Sim. (B)	2.22	1	.25	
A x B	.26	1	.03	
Error	9.05	38		
Trials (T)	54.89	5	11.76**	.17
A x T	4.29	5	.92	
B x T	1.78	5	.38	
A x B x T	1.33	5	.29	
Error	4.67	190		
Cohesion				
Ability (A)	30.56	1	.18	
Att. Sim. (B)	764.02	1	4.42*	.10
A x B	3.31	1	.02	
Error	172.86	38		
Trials (T)	15.63	5	1.28	
A x T	4.01	5	.33	
B x T	16.82	5	1.38	
A x B x T	3.44	5	.28	
Error	12.19	190		

*p < .05 **p < .01

Table 3

Summary of Correlations

Variables	Trials 1	2	3	4	5	6
Attitude Similarity/ Cohesion	11[a]	20	23	27*	34**	28*
Cohesion/Performance	28*	12	-16	-22	05	-30**

[a]Decimal points omitted (N-42)

*p < .10 (two-tailed test)

**p < .05 (two-tailed test)